

INDIANA DEPARTMENT OF TRANSPORTATION
MATERIALS AND TESTS DIVISION

PENETROMETER TESTING OF FLOWABLE MORTAR
ITM No. 213-00T

1.0 SCOPE

1.1 This test method covers the procedure for the determination of the penetration resistance of flowable mortar using the proctor penetrometer.

1.2 The values stated in either SI metric or acceptable English units are to be regarded separately as standard, as appropriate for a specification with which this ITM is used. Within the text, English units are shown in parenthesis. The values stated in each system may not be exact equivalents; therefore each system shall be used independently of the other, without combining values in any way.

1.3 This ITM may involve hazardous materials, operations, and equipment. This ITM does not purport to address all of the safety problems associated with the ITM's use. The ITM user's responsibility is to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2.0 TERMINOLOGY

2.1 Terms and Abbreviations. Definitions for terms and abbreviations shall be in accordance with the Department's Standard Specifications, Section 101, except as follows.

2.1.1 The penetration resistance is a force opposing the ability of the penetrometer needle to move the in-place flowable mortar.

3.0 SIGNIFICANCE AND USE

3.1 This ITM is used to test flowable mortar to ensure that it provides sufficient support for use as a fill material and that it is removable.

4.0 APPARATUS

4.1 The penetrometer is a spring-loaded mechanism, providing load for gradations ranging from 4.54 - 58.97 kg (10- 130 lbs.) at either 4.54 kg (10 lb.) or 0.907 kg (2 lb.) intervals. The penetrometer accommodates interchangeable penetration needles.

4.2 The penetrometer needles are graduated metal rods with varying contact areas used as load bearing surfaces. Typical load bearing surfaces for penetrometer needles are 16.13, 32.26, 64.52, 161.29, 212.90, 322.58, 483.87, and 645.16 mm² (1/40, 1/20, 1/10, 1/5, 1/4, 1/2, 3/4, and 1 in.²). The size range for flowable mortar testing is

typically 16.13, 32.26, 64.52, 161.29 and 212.90 mm² (1/40, 1/20, 1/10, 1/5, and 1/4 in.²).

5.0 SAMPLE PREPARATION

5.1 The lateral dimension of the sample shall be at least 0.6 m (2 ft) and the height of the sample shall be at least 150 mm (6 in.). If a laboratory sample is used for approval, care should be taken to confirm that the container is not watertight.

5.2 Remove the top 13 mm (1/2 in.) of an area approximately 0.6 X 0.6 m (2 X 2 ft) with a square nose shovel to expose new surface.

6.0 PROCEDURE

6.1 Determine the penetration resistance of flowable mortar.

6.1.1 Select the appropriate penetrometer needle based on anticipated penetration resistance. See Appendix A.1

6.1.2 Record the contact area of the penetrometer needle.

6.1.3 Secure the needle to the end of the penetrometer.

6.1.4 Stand directly over the penetrometer, lock your shoulders and apply a force straight down. Any diagonal force may damage smaller needles.

6.1.5 Continue to apply load until the bearing surface of the needle penetrates the flowable mortar by 25 mm (1 in.).

6.1.6 Record the load applied registered by the movement of the sliding ring along the shaft of the penetrometer.

6.1.7 Repeat 6.1.4 through 6.1.6 at three different locations to acquire 3 readings.

6.2 When the penetration resistance exceeds the range of the penetrometer, a determination of removability must be made for submittal to the failed materials committee. Examples of actions are as follows:

6.2.1 Drop the pointed end of a pick from a height of 1 m (3 ft.) to determine if the pick penetrates the flowable mortar, or

6.2.2 Try to dig with a square nosed shovel. If the flowable mortar can be removed with reasonable effort, the material is considered removable.

7.0 CALCULATIONS

7.1 Calculate the penetration resistance of the flowable mortar under test with the following equation:

$$PR = L / A$$

PR = Penetration Resistance, kPa (psi)
 L = Load Applied, N (lb.)
 A = Contact Area of the Penetrometer Needle, m² (in².)

7.2 Calculate the average penetration resistance of the flowable mortar under test with the following equation.

$$APR = (PR_1 + PR_2 + PR_3) / 3$$

APR = Average Penetration Resistance

8.0 REPORT

8.1 Report average penetration resistance to the nearest 50 kPa (10 psi).

8.2 Report removability if penetration resistance cannot be determined.

9.0 PRECISION

9.1 No precision data is available.

APPENDIX

A.1

<u>Penetrometer Needle Contact Area</u>	<u>Anticipated Penetration Resistance</u>
0.0161 m ² (1/40 in. ²)	2750 - 35850 kPa (400 - 5200 psi)
0.0322 m ² (1/20 in. ²)	1400 - 17250 kPa (200 - 2600 psi)
0.0645 m ² (1/10 in. ²)	700 - 9000 kPa (100 - 1300 psi)
0.1290 m ² (1/5 in. ²)	350 - 4500 kPa (50 - 650 psi)
0.1612 m ² (1/4 in. ²)	300 - 3600 kPa (40 - 520 psi)